

Sophie Roman

35 years old

Civil union, 1 child

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Associate Professor (tenured) Experimental microfluidics for geosciences

Keywords: fluid dynamics, microfluidics, microfabrication, imaging, metrology, multiphase flow, reactive transport, porous media.

WORK EXPERIENCES

From Sept. 2017 **Institut des Sciences de la Terre d'Orléans** (ISTO, France), Associate Professor at the University of Orleans, Porous Media Group.



Head of the Nano μ Lab in Orléans– a micronanofluidic facility to investigate coupled processes in porous media and address the societal and environmental challenges of the 21st century.

2013-2017



Stanford University (CA, USA), Energy Resources Engineering Department, post-doctoral fellow (2 years), research scientist (2 years) working with Prof. Anthony Kovscek and Prof. Hamdi Tchelepi.
« *Dynamics of multiphase and reactive flows using microfluidic devices representative of subsurface geological environments* »

2013



Montpellier 2 University (France), Laboratoire Charles Coulomb, post-doctoral fellow (7 months), working with Dr. Vincent Jourdain and Prof. François Henn.
« *Biosensor: confinement of ionic bio-channels inside a carbon nanotube for selective ion transport* »

2009-2012



Institut de Mécanique des Fluides de Toulouse (IMFT, France), PhD student, thesis defended in December 2012 under the supervision of Dr. Sylvie Lorthois and Dr. Frédéric Risso
« *Flow of concentrated suspensions of red blood cells in microchannels: experimental study* ».

2009



Sanofi, Toulouse (France), Scientific Computing & Data Management department, internship (6 months)
« *Acquisition, processing and image analysis* ».

EDUCATION

2009-2012

PhD of National Polytechnic Institute of Toulouse (France), specialized in *Fluid Dynamics*.

2006-2009

Master of Science in Bioscience Engineering, Institute of Biosciences of Paris (France), www.isbs.fr.

Options: biomechanics/biomaterials and bio-imaging/computer science

2004-2006

Preparatory classes in Physics, Chemistry, Mathematics, Biology and Geology for the entrance to French Engineering Schools at Lycée Ozanne (Toulouse, France)

TEACHING & MENTORING

Teaching

2017-current

University of Orléans, Universe Science Observatory (OSUC), 192 hours/year.

Undergraduate and graduate level (lectures and practical work): hydrogeology, reactive transport, geochemistry of natural waters, transport laws and fluid mechanics, modeling of groundwater flows, field course in hydrogeology.

- 2015 **Stanford University**, School of Earth, Energy and Environmental Sciences.
Lecture in the Flow through Porous Media Laboratory class (ENERGY 120A): experimental fluid mechanics in porous media.
- 2009-2012 **Paul Sabatier University** (Toulouse, France), Department of Physical Measurements, 64 hours/year
Undergraduate level (practical works): Electricity, Optics, Solid mechanics.

Supervision of graduate students (MSc, 2 to 6 months internship)

Year	Name	School	Next position
2021	V. Gredicak	Montanuniversität Leoben (AUT)	Ph.D. student, University of Orléans
2021	N. Bernard	Saint-Étienne School of Mines (FR)	tbd
2020	V. Pluvy	University of Orléans (FR)	MSc University of Orléans
2020	J. Alves	University of Orléans (FR)	MSc University of Orléans
2018	A. Ferrah	University of Lorraine (FR)	Engineer at Gaztransport & Technigaz
2018	A. Vella	University of Orléans (FR)	Ph.D. student, University of Orléans
2015	P. Louazel	ENSTA ParisTech (FR)	Aero-Hydro Engineer at Principle Power (USA)

Supervision of PhD students and postdoctoral fellows

- 2021-2024 Viktor Gredicak, Ph.D. student
 2021-2022 Flore Rembert, Postdoctoral fellow
 2020-2022 Khaled Brimo, Postdoctoral fellow
 2019-2022 Mahdi Mansouri-Boroujeni, Ph.D. student

AWARDS

- 2013 **Léopold Escande Prize 2013**: best thesis in Engineering, National Polytechnic Institute of Toulouse.
- 2012 **Best Poster Prize**, 37th Annual Meeting of the Biomechanics Society.
- 2009 **Ph.D. excellence scholarship** from the French Ministère de l'Enseignement Supérieur et de la Recherche.

INSTITUTIONAL RESPONSIBILITIES & REVIEWING ACTIVITIES

Responsible of 5 teaching courses (University of Orléans): Hydrogeology (bachelor), Geochemistry of natural water (bachelor), Hydrogeology (MSc), Reactive transport (MSc), Hydrogeology field camp (MSc)

Reviewer for proposals: National Science Foundation (NSF), American Chemical Society Petroleum Research Fund (ACS PRF)

Reviewer for peer-reviewed journals: Chemical Engineering Science, Scientific Report, Transport in Porous Media, Fuel, Advances in Water Resources, Sensors, Water Resources Research, Chemical Geology, Journal of Colloid and Interface Science, Oil & Gas Science and Technology

MEMBERSHIPS OF SCIENTIFIC SOCIETIES

- 2013-now Member of Interpore, International Society for Porous Media
 2014-now Member of AGU, American Geophysical Union

INVITED CONFERENCE AND PRESENTATIONS (SELECTION)

- 2020 **Webinar**: "Multiphase flow and reactive transport in porous media: an experimental microfluidic approach", PoreLab, Norway, invited, online talk: <https://youtu.be/UzXMGTEpCOs>.
- 2019 **Conference**: "Microfluidics to improve mechanistic understanding of multiphase and reactive flow processes in Earth systems", AGU Fall Meeting, San Francisco, invited speaker.

- 2019 **Conference:** “Combination of microfluidic experiments and numerical simulations to study pore-scale multiphase reactive flow”, Microfluidics 2019: from laboratory tools to process development (France), invited speaker.
- 2019 **Seminar:** “Flow of complex fluids in porous media: an experimental microfluidic approach”, Princeton University (USA), Soft Materials Coffee Hour, on invitation of Ass. Prof. S. Datta.
- 2014 **Seminar:** “Experimental study of the flow of red blood cell suspensions in microchannels”, ARTORG Center, University of Bern (Switzerland), on invitation of Prof. D. Obrist.
- 2014 **Seminar:** “Improved visualization of flow mechanisms in micromodels”, Fluid Mechanics Institute of Toulouse (France), talk on invitation of Prof. M. Quintard.

PUBLICATIONS

Articles published in journals with peer review

- [1] Soulaine C., Girolami L., Arbaret L., **Roman S.**, *Digital Rock Physics: computation of hydrodynamic dispersion*, Oil & Gas Science and Technology - Rev. IFP Energies nouvelles 76, 51, 2021.
- [2] Soulaine C., Maes J., **Roman S.**, *Computational microfluidics for geosciences*. Frontiers in Water, 3, p.11, 2021.
- [3] Poonoosamy J., Soulaine C., Burmeister A., Deissmann G., Bosbach D., **Roman S.**, *Microfluidic flow-through reactor and 3D Raman imaging for in situ assessment of mineral reactivity in porous and fractured porous media*, Lab on a Chip, 20(14), 2562-2571, 2020.
- [4] Molins S., Soulaine C., Prasianakis N. I., Abbasi A., Poncet P., Ladd A. J., Starchenko V., **Roman S.**, Trebotich D., Tchelepi H. A., Steefel, C. I., *Simulation of mineral dissolution at the pore scale with evolving fluid-solid interfaces: Review of approaches and benchmark problem set*, Computational Geosciences, 1-34, 2020.
- [5] **Roman S.**, Soulaine C., Kovscek A. R., *Pore-scale visualization and characterization of viscous dissipation in porous media*. *Journal of colloid and interface science*, 558, 269-279, 2020.
- [6] Soulaine C., **Roman S.**, Kovscek A., Tchelepi H., *Pore-scale modelling of multiphase reactive flow: application to mineral dissolution with production of CO₂*, Journal of Fluid Mechanics, 855: 616-645, 2018.
- [7] **Roman S.**, Abu AlSaud M., Tokunage T., Wan J., Tchelepi H., Kovscek A., *Measurements and simulation of liquid films during drainage displacements and snap-off in constricted capillary tubes*, Journal of Colloid and Interface Science, 507: 279-289, 2017
- [8] Soulaine C., **Roman S.**, Kovscek A., Tchelepi H., *Mineral dissolution and wormholing from a pore-scale perspective*, Journal of Fluid Mechanics, 827: 457-483, 2017.
- [9] Yun W., Ross C. M., **Roman S.**, Kovscek A. R., *Creation of a dual-porosity micromodel with improved realism in both pore structure and flow behavior for the study of immiscible flow in complex porous media*, Lab on a Chip, 8, 2017.
- [10] **Roman S.**, Soulaine C., Abu AlSaud M, Kovscek A., Tchelepi H., *Particle Velocimetry Analysis of Immiscible Two-Phase Flow in Micromodels*, Advances in Water Resources, 95: 199-211, 2016.
- [11] **Roman S.**, Merlo A., Duru P., Risso F., Lorthois S., *Going beyond 20 micrometer-sized channels for studying red blood cell phase separation in microfluidic bifurcations*, Biomicrofluidics, 10:3, 2016.
- [12] Yazda K., **Roman S.**, Tahir S., Henn F. and Jourdain V., *Fabrication of Microfluidic Devices for the study of Ion transport through Single-Walled Carbon Nanotubes*, MRS Advances, 1(28): 2085–2090, 2016.
- [13] Soulaine C., Gjetvaj F., Garing C., **Roman S.**, Russian A., Gouze P., Tchelepi H., *The Impact of Sub-Resolution Porosity of X-ray Microtomography Images on the Permeability*, Transport in Porous Media, 113: 227, 2016.
- [14] **Roman S.**, Lorthois S., Duru P., Risso F., *Velocimetry of red blood cells in microvessels by the dual slit method: effect of velocity gradients*, Microvascular Research: 84: 249-261, 2012.
- [15] Moravec F., **Roman S.**, *Numerical computing of elastic homogenized coefficients for periodic fibrous tissue*, Applied and Computational Mechanics 3: 141-152, 2009.

Conference proceedings published in journals with peer review

- [1] **Roman S.**, Lorthois S., Duru P., Risso F., *Flow of concentrated red blood cell suspensions at micro-bifurcations: an in vitro experimental study*, Computer Methods in Biomechanics and Biomedical Engineering: Suppl 1:33-5, 2013. .
- [2] **Roman S.**, Lorthois S., Duru P., Risso F., *An optimized technique for red blood cells velocity measurement in microvessels*, Journal of Biomechanics, 45: 1-35, 2012.
- [3] Campagnolo L., **Roman S.**, Perchoux J., Lorthois S., *A new optical feedback interferometer for measuring red blood cell velocity distributions in individual capillaries: a feasibility study in microchannels*, Computer Methods in Biomechanics and Biomedical Engineering: 15-S1: 104-105, 2012.
- [4] Nakib A., **Roman S.**, Oulhadj H., Siarry P., *Fast brain MRI segmentation based on two-dimensional survival exponential entropy and particule swarm optimization*, Conference proceedings: Annual International Conference of the IEEE Engineering in Medicine and Biology Society, 5563–5566, 2007.